Outboard and Personal Watercraft Marine Engine Corporate Average Emission Standards, HC+NOx in g/kW-hr

Engine / MY	2001	2002	2003	2004	2005	2006	2007	2008[c]	2009+[c]
Max. FEL	NA			80				44	
P_{tx} < 4.3 kW[a,b]	81.00			64.80				30.00	
P_{tx} ≥ 4.3 kW[a,b]	$(0.25\times(151+557/P_{tx}^{0.9}))+6.0$			$(0.20\times(151+557/P_{tx}^{0.9}))+4.8$				$(0.09\times(151+557/P_{tx}^{0.9}))+2.1$	

a) P_{tx} is the average power in kW (sales-weighted) of the total number of spark-ignition marine engines produced for sale in California in model year x.
Power outputs of outboard engines are determined separately from those of personal watercraft engines.
b) For 2010 and subsequent model years, an engine or engine family's power category is based on maximum engine power; otherwise maximum rated power may be used.
c) For 2010 and subsequent model years, standards are measured in total hydrocarbons plus oxides of nitrogen.

Outboard and Personal Watercraft Carbon Monoxide Standards

Model Year	Power Category[a] (kW)	CO Standard (g/kW-hr)
2009 and later	kW ≤ 40	500 - 5×P[b]
	kW > 40	300.0

a) For 2010 and subsequent model years, an engine or engine family's power category is based on maximum engine power; otherwise maximum rated power may be used.
b) P is defined as maximum rated power or maximum engine power (see footnote a) in kilowatts (kW).

Standard Performance Sterndrive/Inboard Marine Engine Standards

Model Year	Power Category[a]	Compliance Option[b]	Durability (hours/years)	Exhaust Standards			Supplemental Measure[e]
				HC[c]+NOx (g/kW-hr)	Type[d]	CO	
2003-2006	kW ≤ 373	NA	NA	16.0	AVE[f]	NA	None
2007	kW ≤ 373	OPT 1	NA	16.0 (55%)	AVE[f]	NA	None
			480 / 10	5.0 (45%)	FIXED		
		OPT 2	NA	14.0	AVE[f]	NA	Low-Permeatin Fuel Line Hoses
2008	kW ≤ 373	OPT 1	NA	16.0 (25%)	AVE[f]	NA	None
			480 / 10	5.0 (75%)	FIXED		
		OPT 2	480 / 10	5.0	FIXED	NA	Low-Permeatin Fuel Line Hoses
2009 and later	kW ≤ 373	NA	480 /10	5.0[g,h]	FIXED	75.0[g,i]	Carryover[j]

a) For 2010 and subsequent model years, an engine or engine family's power category is based on maximum engine power; otherwise maximum rated power may be used

b) Once a manufacturer has chosen an option, that option must continue to be used exclusively across producct lines

c) For 2010 and subsequent model years, standards are measured in total hydrocarbons plus oxides of nitrogen; however, the non-methane component of hydrocarbon may be substituted in prior years

d) Corporate averaging (AVE) may be used to demonstrate compliance with the exhaust emission standard, except where a FIXED standard is required

e) Supplemental measures may be different than shown, but must provide equal and verifiable emission reductions to those indicated

f) The corporate average calculation may be met with or without power weighting for these years

g) A single engine family certified under the discontinuation allowance in section 2442(g)(2) may continue to meet current certification levels for HC+NOx and no more than 150 g/kW-hr for CO over the engine's useful life provided that the manufacturer certifying such an engine family also certifies one or more engine families to family emissions limits sufficiently low to enable compliance on a corporate average basis

h) Large volume manufacturers that produce high performance engines and qualified intermediate volume manufacturers are required to certify one or more engine families to a family emissions limit lower that the HC+NOx standard when complying with high performance engines on a corporate average basis

i) Standard performance engines ≥ 6.0 liter displacement may alternatively meet a 25 g/kW-hr standard for Modes 2-5 of the ISO 8178-4 E4 marine test cycle

j) The same or better supplemental emission control hardware used comply in 2007 must be used every model year thereafter and all fuel hoses (i.e., not just the fuel line hose) must be low-permeation hoses

High Performance Sterndrive/Inboard Marine Engine Standards

Model Year	Power Category[a] (kW)	Durability (hours/years)	HC[b]+NOx (g/kW-hr)		CO Standard (g/kW-hr)
			Small Volume Mfrs or Intermediate Volume Mfrs that are not Qualified Intermediate Volume Mfrs	Large Volume or Qualified Intermediate Volume Mfrs	
2009 - 2010	373 <kW < 485	150[c]/3	16.0[d]	5.0[e]	350.0[d]
	kW > 485	50[c]/1	25.0[d]		
2011 and later	373 <kW < 485	150[c]/3	16.0[d]	5.0[e]	350.0[d]
	kW > 485	50[c]/1	22.0[d]		

a) For 2010 and subsequent model years, an engine or engine family's power category is based on maximum engine power; otherwise maximum rated power may be used

b) For 2010 and subsequent model years, standards are measured in total hydrocarbons plus oxides of nitrogen; however, the non-methane component of hydrocarbon may be subsituted in prior years

c) For the purpose of durability testing, engine components that have been approved with an hourly warranty period shorter than the full hourly durability period per section 2445.1 (c)(3)(C)4. may be replaced at the specified warranty interval

d) These standards are fixed except that engine families certified under the discontinuation allowance in Title 13, California Code of Regulations, section 2442 (g)(2) may continue to meet current certification levels for HC+NOx over the engine's useful life provided that the manufacturer certifying such an engine family also certifies one or more engine families to family emissions limits sufficiently low to enable compliance on a corporate average basis

e) This standard may be met on a corporate average basis between high performance engines and/or between standard performance and high performance engines. Alternately, large volume manufacturers that produce high performance engines and qualified intermediate volume manufacturers may comply with the exhaust standards for small volume manufacturers provided a sufficient number of vessels with the manufacturer's standard performance engines are equipped with enhanced evaporative control systems as noted in Title 13, California Code of Regulations, section 2442(b)(5). Manufacturers must declare their intent to use this alternative prior to certifying engines for the 2009 model year and must continue to certify future model year engines using this alternative exclusively across product lines

Sterndrive/Inboard Marine Evaporative Design Specifications

	Permeation Standards[a] (grams per square meter per day)	Diurnal Standard[b] (grams per gallon per day)	Test Temperatures (degrees Celsius)
Fuel Hoses	15.0	–	23 ± 2
Fuel Tank	1.5	–	28 ± 2
Trailerable Boat	–	0.40	25.6 - 32.2
Nontrailerable Boat	–	0.16	27.6 - 30.2

a) Fuel hoses and tank permeation performance based on the use of fuel with 10% ethanol content.

b) Diurnal performance based on the use of fuel with 9 pounds per square inch (psi) Reid Vapor Pressure volatility and a 24-hour fuel temperature cycle.

Voluntary Standards

HC[a]+NOx Standard (g/kW-hr)	CO Standard (g/kW-hr)	Permeation Standards (grams per square meter per day)		Diurnal Standard[b] (grams per gallon per day)
		Hose[c]	Tank[d]	
2.50	50.0	15.0	1.5	0.4

a) The exhaust standard includes total hydrocarbons

b) Diurnal performance assumes a trailerable boat and requires fuel with 9 pounds per square inch (psi) volatility and a 24 hour fuel temperature cycle of 25.6 to 32.2 °Celsius

c) Fuel line permeation performance based on the use of gasoline fuel with 10% ethanol content at 23 ± 2° Celsius

d) Fuel tank permeation performance based on the use of gasoline fuel with 10% ethanol content at 28 ± 2° Celsius